Please enter the following new claims, numbered claim 52 through claim 63:

52. A set of coded algorithms, computational processing means, for valuation of a security, a basket of cash receipts constituting a single security, or an aggregated portfolio, providing means for mathematical valuation and sensitivity functions, wherein providing means for determining a singular governing yield value for a portfolio, useful for identifying its composite yield basis, wherein said algorithms also providing means for determining a governing yield value for a single security, wherein said value isomorphic to said security's yield-to-maturity, wherein also providing means for determining a composite yield basis for the individual cash receipts, cash-flows, or premiums, comprising a basket within a single security, said governing yield values useful for quoting the earnings of said security or portfolio and for projecting the change in the price of said security or portfolio respective a change in yield curve respective time, said algorithms satisfying a pricing function, said pricing function providing means for valuation and sensitivity functions for fixed-income bond, equity stock, or insurance premium, securities, respective the endogenous variables of C, Y and T, said pricing function comprising:
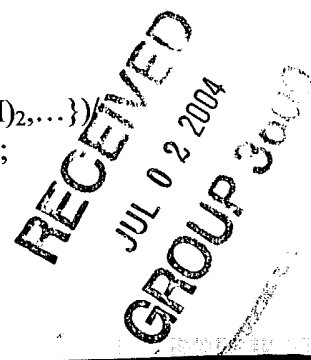
$$P = f \{ C, Y, T \} \text{ where C, Y, and T are variables endogenous to the security}$$
P = Market Price
C = Cash Receipts, periodic coupon, dividend or premium payments
Y = Yield, a single term relating security's return, relative to P, C, T
T = Time, a terminal or continuous measure of the life of the security;

wherein said algorithms also determining a governing yield value on the spot forward curve, said algorithms alternatively comprising the Formula, Yield M, or the Formula, Yield Md,:

$$\text{Yield M} = \frac{\sum (\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Maturity} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein Yield M as coded algorithm:

$$\text{Yield M} = YM = \frac{(\text{sum}\{(\text{Maturity}*\text{Portfolio Coefficient}*YTM)_1, (M*PC*YTM)_2,...\})}{(\text{sum}\{(\text{Maturity}*\text{Portfolio Coefficient})_1, (M*PC)_2,...\})};$$

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$$\text{Yield Md} = \frac{\sum (\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Duration} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein Yield Md as coded algorithm:

$$\text{Yield Md} = \text{YMD} = \frac{(\text{sum}\{(\text{Duration}*\text{PC}*\text{YTM})_1, (\text{D}*\text{PC}*\text{YTM})_2, \ldots\})}{(\text{sum}\{(\text{Duration}*\text{Portfolio Coefficient})_1, (\text{D}*\text{PC})_2, \ldots\})}$$

where Yield M = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, $\sum$ issues
Present Value = Cost to Presently Purchase
    [e.g. for bonds: Accrued Interest + (best bid Price $\times$ Face Value)]
YTM = Yield-To-Maturity, a means providing yield respective time,

for Single Issue: its Portfolio Coefficient is one, its Yield M = its YTM
for Portfolio: the formula creates a single Yield M value of all issues.

53. A set of coded algorithms, computational processing means, providing means for mathematical valuation and sensitivity functions useful for financial securities, comprising means for generating valuation and sensitivity data, useful for establishing hedge ratios and immunization, said algorithms comprising means for identifying yield-to-maturity, duration, and convexity of said security or portfolio, and said algorithms comprising means for establishing sensitivity values useful for projecting or estimating the change in price of said security or portfolio respective a change in yield curve, said coded algorithms comprising:

relation of price to yield-to-maturity, a summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

        where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded algorithm:

$$\text{Price} = P = (C/2)*(\text{sum}\{(((1+(Y/2))\wedge(-T))+((1+(Y/2)\wedge(-2*T)))_1,$$
$$(((1 + (Y/2)\wedge(-T))+((1+(Y/2)\wedge(-2*T)))_2, \ldots\})$$
        where semi-annual coupon payments (2 per annum);

relation of change in price for change in yield, duration, the first order term of a Taylor series approximation to deriving the first derivative of said summed discounted cash receipts:

Duration, modified annualized:

$$\text{(Duration) Durmodan} = \frac{\dfrac{C}{Y^2}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2T(100 - C/Y)}{(1+Y)^{2T+1}}}{2P}$$

where
D = ΔP/ΔYTM
Y = YTM
T = Mat. in Years
C = Coupon
P=Price (par=100),

wherein as coded algorithm:

semi-annual   Durmodan=DURMOD=(((((C/2)/((Y/2)^2))*(1−(1/((1+(Y/2))^(2*T)))))
+((2*T)*(100−((C/2)/(Y/2))))/((1+(Y/2))^((2*T)+1))))/(2*P)
where P = Price (of 100)

generalized   Durmodan=DURMD= (((((C/N)/((Y/N)^2))*(1−(1/((1+(Y/N))^(N*T))))
+(((N*T)*(100−((C/N)/(Y/N))))/((1+(Y/N))^((N*T)+1))))/(2*P)

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years;

relation of change in the change in yield, convexity, the second order term of a Taylor series approximation to deriving the first derivative of said summed discounted cash receipts:

$$\text{(Convexity) Convex} = \frac{\dfrac{2C}{Y^3}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2C(2T)}{Y^2(1+Y)^{2T+2}} + \dfrac{2T(2T+1)(100 - C/Y)}{(1+Y)^{2T+2}}}{4P}$$

wherein as coded algorithm:

semi-annual   Convex = CON = ((((C/((Y/2)^3))*(1−(1/((1+(Y/2))^(2*T)))))
−((C*(2*T))/(((Y/2)^2)*((1+(Y/2))^((2*T)+1))))
+(((2*T)*((2*T)+1)*(100-(C/Y)))/((1+(Y/2))^((2*T)+2))))/(4*P)

generalized   Convex = CONDP = ((((C/((Y/N)^3))*(1−(1/((1+(Y/N))^(N*T)))))
−((C*(N*T))/(((Y/N)^2)*((1+(Y/N))^((N*T)+1))))
+(((N*T)*((N*T)+1)*(100-(C/Y)))/((1+(Y/N))^((N*T)+2))))/(4*P)

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years.

54. A set of coded algorithms, computational processing means, providing means for mathematical valuation and sensitivity functions useful for financial securities, comprising means for generating valuation and sensitivity data, useful for establishing hedge ratios and immunization, said algorithms comprising means for identifying yield-to-maturity, duration, and convexity of said security or portfolio, and said algorithms comprising means for establishing sensitivity values useful for projecting or estimating the change in price of said security or portfolio respective a change in yield curve, said coded algorithms comprising:

relation of price to yield-to-maturity, a non-summation form discounting cash receipts:

$$\text{Price} = \frac{C}{Y}\,(1 - (1 + Y/2)^{-2T}) \; + \; (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded algorithm:

semi-annual   P = PR = $((C/Y)*(1-(1+(Y/2))^{\wedge}(-2*T))+(1+(Y/2))^{\wedge}(-2*T)$
where C, Y and P are decimal values, T=Maturity in years,

generalized   P = PRBOND= $((C/Y)*(1-(1+(Y/N))^{\wedge}(-N*T))+(1+(Y/N))^{\wedge}(-N*T)$
where N=n= cash receipts per annum, e.g. semi-annual=2;

relation of change in price for change in yield, duration, precise first derivative of said non-summation form discounting cash receipts, utilizing endogenous variables C, Y, T only:

Duration, modified annualized, semi-annual C:

$$K \qquad = \frac{-C}{Y^2}(1 - (1 + Y/2)^{-2T}) + \frac{C}{Y}\,(T + TY/2)^{-2T-1} \; - \; (T + TY/2)^{-2T-1}$$

where C=Coupon   Y=YTM   T=Maturity in Years $\delta Y=\Delta$Yield M $\delta P=\Delta$Price

Duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2}(1 - (1 + Y/n)^{-nT}) + \frac{C}{Y}\,(T + TY/n)^{-nT-1} \; - \; (T + TY/n)^{-nT-1}$$

wherein n = # cash receipts per annum, whereas semi-annual form can also be written:

$$K \qquad = \quad \frac{-C}{Y^2} + \frac{C}{Y^2}(1 + Y/2)^{-2T} \; - \; (1 - C/Y)(T + TY/2)^{-2T-1}$$

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wherein as coded algorithms:

K semi-annual = DPDY = $((-C/(Y^2))*(1-((1+(.5*Y))^(-2*T))))$
$+((C/Y)*((T+(.5*Y*T))^((-2*T)-1)))$
$-((T+(.5*Y*T))^((-2*T)-1))$

where C and Y are decimal values, T=Maturity in years

K generalized =BONK= $((-C/(Y^2))*(1-((1+(Y/N))^(-N*T))))$
$+(((C/Y)-1)*T*((1+(Y/N))^((-N*T)-1)))$

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation
K generalized =BINK= $(-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^(-N*T)))$
alternate form $-((1-(C/Y))*((T+((T*Y)/N))^((-N*T)-1)))$;

relation of change in the change in yield, convexity, precise second derivative of said

non-summation form discounting cash receipts, utilizing endogenous variables C, Y, T only:

Convexity
$$V = \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M – YTM basis,

wherein as coded algorithms:
generalized
V   =BONV= $(((2*C)/(Y^3))*(1-(1+(Y/N))^(-N*T)))$
$-((C/Y^2)*(2*T)*((1+(Y/N))^((-N*T)-1)))$
$-(((C/Y)-1)*(((N*T)+1)*(T/N))*((1+(Y/N))^((-N*T)-2)))$

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual
V   =VEXA= $(((2*C)/(Y^3))-(((2*C)/(Y^3))*((1+(Y/2))^(-2*T)))$
$-((C*T)/(Y^2))*((1+(Y/2))^(-2*T)-1))$
$-((C/(Y^2))*((T+(T*(Y/2)))^((-2*T)-1)))$
$+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^((-2*T)-2))))/10000$

where e.g. Y=spread=YieldM–YTM, expressed in decimal, i.e. if Y=0.14%=0.14
where e.g. Y=Yield M, expressed in decimal, i.e. if Y= Yield M= 6.06%= 0.0606

spread-based, generalized
V   =VEX= $(((2*C)/(Y^3))-(((2*C)/(Y^3))*((1+(Y/N))^(-N*T)))$
$-((C*T)/(Y^2))*((1+(Y/N))^((-N*T)-1))$
$-((C/(Y^2))*((T+(T*(Y/N)))^((-N*T)-1)))$
$+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^((-N*T)-2))))/10000$

where e.g. Y = Yield M, expressed in decimal, i.e. if Y = Yield M = 6.06% = 0.0606.

55.   A process for the manufacture of financial data using the endogenous variables of a financial security, wherein said financial security comprises a bond, equity or insurance policy, and wherein said process useful to estimating change in the security's price given change in its yield, and useful to quoting yield and for setting hedge ratios and immunization, and useful to programming and coding in computer systems and calculative devices, which comprises:

identifying the data values for the security's endogenous variables, of C, Y, and T, wherein said variable C comprises cash receipts, said cash receipts comprising interest coupons, dividend payments, or insurance premiums, and wherein said variable Y comprises yield, said yield comprises a singular measure relating price, cash receipts and time, and wherein said variable T comprises time (a continuous or discrete measure), said time comprises the time-to-maturity of a bond, the expected life of an equity issuer, or the term of an insurance policy;

determining governing yield, for a single security issue, or for a portfolio of issues, or for a basket of divisible cash receipts, wherein applying processing function Yield M (or Md), determining yield-to-maturity per summation form or per non-summation form, wherein:

function of yield-to-maturity, a summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

Price= P = (C/2)*(sum{((((1+(Y/2))^(-T))+((1+(Y/2)^(-2*T)))), (((1 + (Y/2)^(-T))+((1+(Y/2)^(-2*T)))$_2$,...})

where semi-annual coupon payments (2 per annum);

Price= P = (C/N)*(sum{((((1+(Y/N))^(-T))+((1+(Y/N)^(-N*T)))), (((1 + (Y/N)^(-T))+((1+(Y/N)^(-N*T)))$_2$,...})

where N-annual coupon payments (N per annum);

function of yield-to-maturity, non-summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{Y}(1 - (1 + Y/2)^{-2T}) + (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

semi-annual   P = PR = ((C/Y)*(1−(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)
where C, Y and P are decimal values, T=Maturity in years,

generalized   P = PRBOND= ((C/Y)*(1−(1+(Y/N))^(-N*T))+(1+(Y/N))^(-N*T)
where N=n= cash receipts per annum, e.g. semi-annual=2;

function of governing yield, a singular universal form for securities:

$$\text{Yield M} = \frac{\sum (\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{for all issues}}{\sum (\text{Maturity} \times \text{Portfolio Coefficient}), \text{for all issues}}$$

wherein Yield M as coded computational processing algorithm:

Yield M =YM = (sum{(Maturity*Portfolio Coefficient*YTM)$_1$, (M*PC*YTM)$_2$,...})/
(sum{(Maturity*Portfolio Coefficient)$_1$, (M*PC)$_2$,...});

$$\text{Yield Md} = \frac{\sum (\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{for all issues}}{\sum (\text{Duration} \times \text{Portfolio Coefficient}), \text{for all issues}}$$

wherein Yield Md as coded computational processing algorithm:

Yield Md =YMD = (sum{(Duration*PC*YTM)$_1$, (D*PC*YTM)$_2$,...})/
(sum{(Duration*Portfolio Coefficient)$_1$, (D*PC)$_2$,...})

where   Yield M = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, $\sum$ issues
Present Value = Cost to Presently Purchase
    [e.g. for bonds: Accrued Interest + (best bid Price × Face Value)]
YTM = Yield-To-Maturity, a means providing yield respective time,
    determining YTM by summation or non-summation form,

for Single Issue: its Portfolio Coefficient is one, its Yield M = its YTM
for Portfolio: the functions create a single Yield M value of all issues;

determining arbitrage spreads between Yield M and spot, and Yield M and YTM, wherein said applicable spot is the zero rate, equivalent to the T variable, on the zero rate curve;

calculating a singular price, utilizing said endogenous and determined values of C, Yield M, and T, and solving price, using said summation form or said non-summation form, wherein said price serves as an analytic or expected price useful to determining relative value;

determining measures of the security's pricing sensitivities, duration and convexity, as Taylor series first and second order terms, or as first and second derivatives, respectively, wherein:

function of change in price for change in yield, duration, the first order term of a Taylor series approximation to deriving the first derivative of summed discounted cash receipts:

Duration, modified annualized:

$$\text{(Duration) Durmodan} = \frac{\dfrac{C}{Y^2}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2T(100 - C/Y)}{(1+Y)^{2T+1}}}{2P}$$

where
$D = \Delta P/\Delta YTM$
$Y = YTM$
$T = \text{Mat. in Years}$
$C = \text{Coupon}$
$P = \text{Price (par=100)}$,

wherein as coded computational processing algorithms:

semi-annual Durmodan=DURMOD=(((((C/2)/((Y/2)^2))*(1–(1/((1+(Y/2))^(2*T)))))
+((2*T)*(100–((C/2)/(Y/2))))/((1+(Y/2))^((2*T)+1))))/(2*P)
where P = Price (of 100)

generalized Durmodan=DURMD= (((((C/N)/((Y/N)^2))*(1–(1/((1+(Y/N))^(N*T))))
+(((N*T)*(100–((C/N)/(Y/N))))/((1+(Y/N))^((N*T)+1))))/(2*P)

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years;

function of change in the change in yield, convexity, the second order term of a Taylor series approximation to deriving the first derivative of summed discounted cash receipts:

$$\text{(Convexity) Convex} = \frac{\dfrac{2C}{Y^3}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2C(2T)}{Y^2(1+Y)^{2T+2}} + \dfrac{2T(2T+1)(100 - C/Y)}{(1+Y)^{2T+2}}}{4P}$$

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wherein as coded computational processing algorithms:

semi-annual   Convex = CON = ((((C/((Y/2)^3))*(1−(1/((1+(Y/2))^(2*T)))))
              −((C*(2*T))/(((Y/2)^2)*((1+(Y/2))^((2*T)+1))))
              +(((2*T)*((2*T)+1)*(100-(C/Y)))/((1+(Y/2))^((2*T)+2))))/(4*P)

generalized   Convex = CONDP = ((((C/((Y/N)^3))*(1−(1/((1+(Y/N))^(N*T)))))
              −((C*(N*T))/(((Y/N)^2)*((1+(Y/N))^((N*T)+1))))
              +(((N*T)*((N*T)+1)*(100-(C/Y)))/((1+(Y/N))^((N*T)+2))))/(4*P)

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years;

and wherein:

function of change in price for change in yield, duration, precise first derivative

of non-summation form discounting cash receipts, utilizing endogenous variables C, Y, T only:

Duration, modified annualized, semi-annual C:

$$K = \frac{-C}{Y^2}(1 - (1+Y/2)^{-2T}) + \frac{C}{Y}(T+TY/2)^{-2T-1} - (T+TY/2)^{-2T-1}$$

where C=Coupon   Y=YTM   T=Maturity in Years $\delta Y = \Delta$Yield M $\delta P = \Delta$Price

Duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2}(1 - (1+Y/n)^{-nT}) + \frac{C}{Y}(T+TY/n)^{-nT-1} - (T+TY/n)^{-nT-1}$$

wherein n = # cash receipts per annum, whereas semi-annual form can also be written:

$$K = \frac{-C}{Y^2} + \frac{C}{Y^2}(1+Y/2)^{-2T} - (1 - C/Y)(T+TY/2)^{-2T-1}$$

wherein as coded computational processing algorithms:

K semi-annual = DPDY =   ((-C/(Y^2))*(1−((1+(.5*Y))^(-2*T))))
                         +((C/Y)*((T+(.5*Y*T))^((-2*T) −1)))
                         −((T+(.5*Y*T))^((-2*T) −1))
              where C and Y are decimal values, T=Maturity in years

K generalized =BONK=   ((-C/(Y^2))*(1−((1+(Y/N))^(-N*T))))
                       +(((C/Y) −1)*T*((1+(Y/N))^((-N*T)−1)))
              where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation
K generalized =BINK= $(-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^{(-N*T)}))$
alternate form $-((1-(C/Y))*((T+((T*Y)/N))^{((-N*T)-1)}));$

function of change in the change in yield, convexity, precise second derivative

of non-summation form discounting cash receipts, utilizing endogenous variables C, Y, T only:

$$
\text{Convexity} \quad V = \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}
$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M – YTM basis,

wherein as coded computational processing algorithms:

generalized
V =BONV= $(((2*C)/(Y^3))*(1-(1+(Y/N))^{(-N*T)}))$
$-((C/Y^2)*(2*T)*((1+(Y/N))^{((-N*T)-1)}))$
$-(((C/Y)-1)*(((N*T)+1)*(T/N))*((1+(Y/N))^{(-N*T)-2)}))$
where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual
V =VEXA= $(((2*C)/(Y^3))-(((2*C)/(Y^3))*((1+(Y/2))^{(-2*T)})))$
$-((C*T)/(Y^2))*((1+(Y/2))^{((-2*T)-1)}))$
$-((C/(Y^2))*((T+(T*(Y/2)))^{((-2*T)-1)})))$
$+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^{((-2*T)-2)})))/10000$
where e.g. Y=spread=YieldM–YTM, expressed in decimal, i.e. if Y=0.14%=0.14
where e.g. Y=Yield M, expressed in decimal, i.e. if Y= Yield M= 6.06%= 0.0606

spread-based, generalized
V =VEX= $(((2*C)/(Y^3))-(((2*C)/(Y^3))*((1+(Y/N))^{(-N*T)})))$
$-((C*T)/(Y^2))*((1+(Y/N))^{((-N*T)-1)}))$
$-((C/(Y^2))*((T+(T*(Y/N)))^{((-N*T)-1)})))$
$+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^{((-N*T)-2)})))/10000$
where e.g. Y = Yield M, expressed in decimal, i.e. if Y = Yield M = 6.06% = 0.0606.

56.   A process for estimating change in price of a security, or of an aggregated portfolio,

respective change in yield, instantaneous or as occurring over time, useful to projecting and

forecasting future values of said security or portfolio given change in yield over time, and

useful to programming in computer systems and computational devices, comprising:

utilizing data values of said security's Yield M or Md, Duration K, and Convexity V, wherein said Yield M or Md, Duration K and Convexity V computing by operating mathematical processing codes in computer systems and computational devices, wherein:

Yield M = $\dfrac{\sum (\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{for all issues}}{\sum (\text{Maturity} \times \text{Portfolio Coefficient}), \text{for all issues}}$

wherein Yield M as coded computational processing algorithm:

Yield M =YM = (sum{(Maturity*Portfolio Coefficient*YTM)$_1$, (M*PC*YTM)$_2$,...})/
(sum{(Maturity*Portfolio Coefficient) $_1$, (M*PC) $_2$,...});

Yield Md = $\dfrac{\sum (\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{for all issues}}{\sum (\text{Duration} \times \text{Portfolio Coefficient}), \text{for all issues}}$

wherein Yield Md as coded computational processing algorithm:

Yield Md =YMD = (sum{(Duration*PC*YTM)$_1$, (D*PC*YTM) $_2$,...})/
(sum{(Duration*Portfolio Coefficient) $_1$, (D*PC) $_2$,...})

where Yield M = Governing Yield = Y
Maturity = Time = Maturity in Years, Expected Life, Term of Policy
Portfolio Coefficient = Present Value, per issue/Present Value, $\sum$ issues
Present Value = Cost to Presently Purchase
[e.g. for bonds: Accrued Interest + (best bid Price × Face Value)]
YTM = Yield-To-Maturity, a means providing yield respective time,
determining YTM by summation or non-summation form,

for Single Issue: its Portfolio Coefficient is one, its Yield M = its YTM
for Portfolio: the functions create a single Yield M value of all issues;

Duration, modified annualized, semi-annual C:

$$K = \frac{-C}{Y^2}\left(1 - (1 + Y/2)^{-2T}\right) + \frac{C}{Y}(T + TY/2)^{-2T-1} - (T + TY/2)^{-2T-1}$$

where C=Coupon   Y=YTM   T=Maturity in Years $\delta Y = \Delta$Yield M $\delta P = \Delta$Price

Duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2}\left(1 - (1 + Y/n)^{-nT}\right) + \frac{C}{Y}(T + TY/n)^{-nT-1} - (T + TY/n)^{-nT-1}$$

wherein n = # cash receipts per annum, whereas semi-annual form can also be written:

$$K \quad = \quad \frac{-C}{Y^2} + \frac{C}{Y^2}(1 + Y/2)^{-2T} - (1 - C/Y)(T + TY/2)^{-2T-1}$$

wherein as coded computational processing algorithms:

K semi-annual = DPDY =   ((-C/(Y^2))*(1−((1+(.5*Y))^(-2*T))))
                                +((C/Y)*((T+(.5*Y*T))^((-2*T) −1)))
                                −((T+(.5*Y*T))^((-2*T) −1))
where C and Y are decimal values, T=Maturity in years

K generalized =BONK=   ((-C/(Y^2))*(1−((1+(Y/N))^(-N*T))))
                                +(((C/Y) −1)*T*((1+(Y/N))^((-N*T)−1)))
where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation
K generalized =BINK=   (-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^(-N*T)))
alternate form   −((1−(C/Y))*((T+((T*Y)/N))^((-N*T) −1)));

Convexity
$$V \quad = \quad \frac{2C}{Y^3} - \frac{\frac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\frac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\frac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M − YTM basis,

wherein as coded computational processing algorithms:

generalized
V   =BONV=   (((2*C)/(Y^3))*(1−(1+(Y/N))^(-N*T)))
                         −((C/Y^2)*(2*T)*((1+(Y/N))^((-N*T) −1)))
                         −(((C/Y) −1)*(((N*T)+1)*(T/N))*((1+(Y/N))^((-N*T) −2)))
where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual
V   =VEXA=   (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/2))^(-2*T)))
                         −((C*T)/(Y^2))*((1+(Y/2))^((-2*T) −1))
                         −((C/(Y^2))*((T+(T*(Y/2)))^((-2*T) −1)))
                 +((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^((-2*T) −2))))/10000
where e.g. Y=spread=YieldM−YTM, expressed in decimal, i.e. if Y=0.14%=0.14
where e.g. Y=Yield M, expressed in decimal, i.e. if Y= Yield M= 6.06%= 0.0606

spread-based, generalized
V   =VEX=   (((2*C)/(Y^3)) −(((2*C)/(Y^3))*((1+(Y/N))^(-N*T)))
                       −((C*T)/(Y^2))*((1+(Y/N))^((-N*T) −1))
                     −((C/(Y^2))*((T+(T*(Y/N)))^((-N*T) −1)))
               +((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^((-N*T) −2))))/10000
where e.g. Y = Yield M, expressed in decimal, i.e. if Y = Yield M = 6.06% = 0.0606;

identifying change in said Yield M data value at instant or as occurring over time, wherein measuring, entering or updating input values of variables determining Yield M value;

calculating the change in price of the security given said change in said Yield M by implementing factorization, wherein utilizing K for duration, Δ Price, due to Duration (K):

A: Δ Price, due to Duration (K) = K $\times$ Δ Y;

calculating the change in price of the security given said change in said Yield M by implementing factorization, wherein utilizing V for convexity, Δ Price, due to Convexity (V):

B: Δ Price, due to Convexity (V) = $\frac{1}{2}$ $\times$ V $\times$ $(\Delta Y)^2$;

summing the values determined by A+B, wherein comprising Δ Price, due to K and V:

$$\Delta \text{Price} = (K \times \Delta Y) + (\tfrac{1}{2} \times V \times (\Delta Y)^2);$$

determining arbitrage spread of computed Δ Price versus actual notched Δ Price, wherein calculating the differential between said computed and said actual notched Δ Price;

sending said determined and calculated Yield M or MD, K and V values, and said computed and actual Δ Price, and arbitrage spread to output, monitor, storage or further process.

57.   The method of claim 56, which further comprises an universal factorization:

$$\Delta \text{Price} = (- |\text{Duration}| \times \delta Y) + (\tfrac{1}{2} \times \text{Convexity} \times (\delta Y)^2);$$

wherein $\delta Y \cong \Delta Y$, and wherein $\Delta Y = \Delta$Yield M or ΔYield-to-Maturity,

wherein ΔYield-to-Maturity = YTM as non-summation, or as summation, form:

function of yield-to-maturity, non-summation form of discounted cash receipts:

Price = $\dfrac{C}{Y}$ $(1 - (1 + Y/2)^{-2T})$ + $(1 + Y/2)^{-2T}$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

semi-annual   P = PR =   ((C/Y)*(1–(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)

where C, Y and P are decimal values, T=Maturity in years,

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generalized $P = PRBOND = ((C/Y)*(1-(1+(Y/N))^{\wedge}(-N*T))+(1+(Y/N))^{\wedge}(-N*T)$
                where N=n= cash receipts per annum, e.g. semi-annual=2;

function of yield-to-maturity, a summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

                where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

Price= $P = (C/2)*(sum\{(((1+(Y/2))^{\wedge}(-T))+((1+(Y/2)^{\wedge}(-2*T)))_1,$
            $(((1 + (Y/2)^{\wedge}(-T))+((1+(Y/2)^{\wedge}(-2*T)))_2,...\})$

                where semi-annual coupon payments (2 per annum);

Price= $P = (C/N)*(sum\{(((1+(Y/N))^{\wedge}(-T))+((1+(Y/N)^{\wedge}(-N*T)))_1,$
            $(((1 + (Y/N)^{\wedge}(-T))+((1+(Y/N)^{\wedge}(-N*T)))_2,...\})$

                where N-annual coupon payments (N per annum);

and wherein Duration = K, or as = first order Taylor series approximation of first

derivative of summation form YTM, wherein said first order approximation comprising:

$$\text{(Duration)}\quad \text{Durmodan} = \frac{\dfrac{C}{Y^2}\left[1 - \dfrac{1}{(1 + Y)^{2T}} \right] + \dfrac{2T(100 - C/Y)}{(1 + Y)^{2T+1}}}{2P}$$

where $D = \Delta P/\Delta YTM$
$Y = YTM$
$T = $ Mat. in Years
$C = $ Coupon
$P = $ Price (par=100),

wherein as coded computational processing algorithms:

semi-annual   Durmodan=DURMOD=$(((((C/2)/((Y/2)^{\wedge}2))*(1-(1/((1+(Y/2))^{\wedge}(2*T)))))$
                $+((2*T)*(100-((C/2)/(Y/2))))/((1+(Y/2))^{\wedge}((2*T)+1))))/(2*P)$
                where P = Price (of 100)

generalized   Durmodan=DURMD= $(((((C/N)/((Y/N)^{\wedge}2))*(1-(1/((1+(Y/N))^{\wedge}(N*T))))$
                $+(((N*T)*(100-((C/N)/(Y/N))))/((1+(Y/N))^{\wedge}((N*T)+1))))/(2*P)$

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years;

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and wherein Convexity = V, or as = second order Taylor series term, comprising

second derivative approximation of summation form YTM, wherein said second order term:

$$\text{(Convexity)}\ \text{Convex} = \frac{\dfrac{2C}{Y^3}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2C(2T)}{Y^2\,(1+Y)^{2T+2}} + \dfrac{2T(2T+1)(100-C/Y)}{(1+Y)^{2T+2}}}{4P}$$

wherein as coded algorithm:

semi-annual   Convex = CON = ((((C/((Y/2)^3))*(1−(1/((1+(Y/2))^(2*T))))))
         −((C*(2*T))/(((Y/2)^2)*((1+(Y/2))^((2*T)+1))))
         +((((2*T)*((2*T)+1)*(100−(C/Y)))/((1+(Y/2))^((2*T)+2)))))/(4*P)

generalized   Convex = CONDP = ((((C/((Y/N)^3))*(1−(1/((1+(Y/N))^(N*T))))))
         −((C*(N*T))/(((Y/N)^2)*((1+(Y/N))^((N*T)+1))))
         +((((N*T)*((N*T)+1)*(100−(C/Y)))/((1+(Y/N))^((N*T)+2)))))/(4*P)

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years.

58.   The method of claim 56, which further comprises adding a derivative respecting time, and further comprises adding any accrued interest, wherein using dirty (full) price in A and B:

$$\Delta P = A + B + C + D$$

wherein,

$\Delta P = $ change in bid price, for given changes in yield and time,

$A = -\text{abs(Duration)} \times \text{Price(dirty)} \times \Delta Y$

$B = \tfrac{1}{2} \times \text{Convexity} \times \text{Price(dirty)} \times (\Delta Y)^2$

$C = \text{Theta} \times \text{Price(dirty)} \times \Delta t$

$D = -(\Delta \text{ Accrued Interest, for given } \Delta t),$

and wherein,

Y (YTM), by Formula Yield M, or Yield Md, or

YTM by non-summation or by summation form function,

Duration by Formula K, or by first term Taylor series approximation,

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Convexity by Formula V, or by second term Taylor series approximation,

Theta (θ), such a theta: $\theta = 2 \ln(1+r/2)$, wherein r = ytm or Yield M,

Price (dirty) equals bid price plus accumulated interest,

Δt is elapsed time between two points whereby estimations are made,

ΔP rounded to nearest pricing gradient, ΔP occurring Δt, determining

arbitrage spread of computed Δ Price versus actual notched Δ Price.

59.   A process for valuing a financial portfolio, containing more than one divisible issue, by

singular portfolio (P) data values of endogenous variables C^P, Y^P, T^P, said method to

comparing portfolios and to hedging, immunizing and replicating values of a portfolio, wherein

said process operating in computer system or computational device, comprising:

identifying the data values for each issue's endogenous variables of C, Y, T, wherein:

C = Cash Receipts, periodic coupon, dividend or premium payments
Y = Yield, a single term relating security's return, relative to P, C, T
T = Time = Maturity in Years, Expected Life, Term of Policy;

generating the portfolio coefficients for each issue in portfolio, by:

Portfolio Coefficient, per each Issue = Present Value^I/Present Value^P;

Present Value^I = (AI + (Bid Price×Face Value)), per Issue (I);

Present Value^P = $\sum$ (AI+(Bid Price×Face Value), for all Issues;

generating aggregate portfolio (P) data relating portfolio's value, by:

Present Value^P = $\sum$ (AI + (Bid Price × Face Value), for all Issues;

Accrued Interest^P = $\sum$ Accrued Interest, AI, for all Issues;

Face Value^P = $\sum$ Face Value, for all Issues;

Implied Price^P = (Present Value^P – AI^P)/ $\sum$ Face Value for all Issues;

generating aggregate portfolio (P) data relating portfolio's variables:

$$C^P = \text{Cash Flow}^P = \sum C \times \text{Portfolio Coefficient, for all Issues;}$$

$$T^P = \text{Time}^P = \sum \text{Maturity} \times \text{Portfolio Coefficient, for all Issues;}$$

$$Y^P = \text{Yield}^P = \sum \text{Yield} \times \text{Portfolio Coefficient, for all Issues;}$$

if for a portfolio of U. S. Treasury issues, C^P, Y^P, T^P are:

$$C^P = \text{Coupon}^P = \sum \text{Coupon} \times \text{Portfolio Coefficient, for all Issues;}$$

$$T^P = \text{Maturity}^P = \sum \text{Maturity} \times \text{Portfolio Coefficient, for all Issues;}$$

$$Y^P = \text{Yield}^P = \sum \text{Yield} \times \text{Portfolio Coefficient, for all Issues;}$$

processing C, Y, T, per issue, portfolio's duration and convexity:

$$\text{Duration}^P = \sum \text{Duration} \times \text{Portfolio Coefficient, for all Issues;}$$

$$\text{Convexity}^P = \sum \text{Convexity} \times \text{Portfolio Coefficient, for all Issues.}$$

or utilizing portfolio values, C^P, Y^P, T^P, calculating Duration and Convexity.

60. In the invention of claim 59, which further comprises establishing a governing yield value for the portfolio, wherein said value also representing a yield value relative the spot forward curve, said value calculating by the Formula, Yield M, or the Formula, Yield Md,:

$$\text{Yield M} = \frac{\sum (\text{Maturity} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Maturity} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein Yield M as coded algorithm:

$$\text{Yield M} = YM = (\text{sum}\{(\text{Maturity} \ast \text{Portfolio Coefficient} \ast \text{YTM})_1, (M \ast PC \ast YTM)_2,...\}) / (\text{sum}\{(\text{Maturity} \ast \text{Portfolio Coefficient})_1, (M \ast PC)_2,...\});$$

$$\text{Yield Md} = \frac{\sum (\text{Duration} \times \text{Portfolio Coefficient} \times \text{Yield-To-Maturity}), \text{ for all issues}}{\sum (\text{Duration} \times \text{Portfolio Coefficient}), \text{ for all issues}}$$

wherein Yield Md as coded algorithm:

$$\text{Price} = \frac{C}{2} \sum_{T=1}^{2T} (1 + Y/2)^{-T} + (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

Price= P = (C/2)*(sum{((($1+(Y/2))^{(-T)}$)+(($1+(Y/2)^{(-2*T)}$)))₁,
        ((($1 + (Y/2)^{(-T)}$)+(($1+(Y/2)^{(-2*T)}$))) ₂,...})

where semi-annual coupon payments (2 per annum);

Price= P = (C/N)*(sum{((($1+(Y/N))^{(-T)}$)+(($1+(Y/N)^{(-N*T)}$)))₁,
        ((($1 + (Y/N)^{(-T)}$)+(($1+(Y/N)^{(-N*T)}$))) ₂,...})

where N-annual coupon payments (N per annum); or

function of yield-to-maturity, non-summation form of discounted cash receipts:

$$\text{Price} = \frac{C}{Y} (1 - (1 + Y/2)^{-2T}) + (1 + Y/2)^{-2T}$$

where C = Coupon   Y = YTM   T = Maturity (in years),

wherein as coded computational processing algorithm:

semi-annual   P = PR = ((C/Y)*(1–(1+(Y/2))^(-2*T))+(1+(Y/2))^(-2*T)
            where C, Y and P are decimal values, T=Maturity in years,

generalized   P = PRBOND= ((C/Y)*(1–(1+(Y/N))^(-N*T))+(1+(Y/N))^(-N*T)
            where N=n= cash receipts per annum, e.g. semi-annual=2;

means sending governing yield value and the market yield values to processing, wherein

computing duration, convexity and theta of said security, wherein comprising if governing yield

or market yield non-summation form utilizing applicable coded computational algorithms:

function of duration, modified annualized, semi-annual C:

$$K = \frac{-C}{Y^2} (1 - (1 + Y/2)^{-2T}) + \frac{C}{Y} (T + TY/2)^{-2T-1} - (T + TY/2)^{-2T-1}$$

where C=Coupon   Y=YTM   T=Maturity in Years $\delta Y = \Delta$Yield M $\delta P = \Delta$Price

function of duration, modified annualized, wherein n annual C payments:

$$K \text{ generalized} = \frac{-C}{Y^2} (1 - (1 + Y/n)^{-nT}) + \frac{C}{Y} (T + TY/n)^{-nT-1} - (T + TY/n)^{-nT-1}$$

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wherein n = # cash receipts per annum, whereas semi-annual form can also be written:

$$K \quad = \quad \frac{-C}{Y^2} + \frac{C}{Y^2}(1+Y/2)^{-2T} - (1-C/Y)(T+TY/2)^{-2T-1}$$

wherein as coded computational processing algorithms:

K semi-annual = DPDY = $((-C/(Y^2))*(1-((1+(.5*Y))^{(-2*T))))$
$+((C/Y)*((T+(.5*Y*T))^{((-2*T)}-1)))$
$-((T+(.5*Y*T))^{((-2*T)}-1))$

where C and Y are decimal values, T=Maturity in years

K generalized =BONK= $((-C/(Y^2))*(1-((1+(Y/N))^{(-N*T))))$
$+(((C/Y)-1)*T*((1+(Y/N))^{((-N*T)}-1)))$

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

generalized, alternate formulation:

K generalized =BINK= $(-C/(Y^2))+((C/(Y^2))*((1+(Y/N))^{(-N*T)}))$
alternate form $-((1-(C/Y))*((T+((T*Y)/N))^{((-N*T)}-1)));$

function of convexity, semi-annual C:

$$\text{Convexity} \quad V \quad = \quad \frac{2C}{Y^3} - \frac{\dfrac{2C}{Y^3}}{(1+Y/2)^{2T}} - \frac{\dfrac{CT}{Y^2}}{(1+Y/2)^{2T+1}} - \frac{\dfrac{C}{Y^2}}{(T+TY/2)^{2T+1}} + \frac{(1+C/Y)(T^2+T/2)}{(T+TY/2)^{2T+2}}$$

wherein V can be calculated where Y = YTM, Yield M, or, Yield M – YTM basis,

wherein as coded computational processing algorithms:

generalized
V =BONV= $(((2*C)/(Y^3))*(1-(1+(Y/N))^{(-N*T)}))$
$-((C/Y^2)*(2*T)*((1+(Y/N))^{((-N*T)}-1)))$
$-(((C/Y)-1)*(((N*T)+1)*(T/N))*((1+(Y/N))^{((-N*T)}-2)))$

where C and Y are decimal values; N=n= #C periods per annum; T=Maturity in years

spread-based, semi-annual
V =VEXA= $((((2*C)/(Y^3))-(((2*C)/(Y^3))*((1+(Y/2))^{(-2*T)}))$
$-((C*T)/(Y^2))*((1+(Y/2))^{(-2*T)}-1))$
$-((C/(Y^2))*((T+(T*(Y/2)))^{((-2*T)}-1)))$
$+((1+(C/Y))*((T^2)+(T/2))*((T+(T*(Y/2)))^{((-2*T)}-2))))/10000$

where e.g. Y=spread=YieldM–YTM, expressed in decimal, i.e. if Y=0.14%=0.14
where e.g. Y=Yield M, expressed in decimal, i.e. if Y= Yield M= 6.06%= 0.0606

spread-based, generalized

V   =VEX= $((2*C)/(Y^3)) -(((2*C)/(Y^3))*((1+(Y/N))^{(-N*T)}))$

$-((C*T)/(Y^2))*((1+(Y/N))^{((-N*T)} -1))$

$-((C/(Y^2))*((T+(T*(Y/N)))^{(-N*T)} -1)))$

$+((1+(C/Y))*((T^2)+(T/N))*((T+(T*(Y/N)))^{(-N*T)} -2))))/10000$

where e.g. Y = Yield M, expressed in decimal, i.e. if Y = Yield M = 6.06% = 0.0606;

wherein comprising if market yield summation form utilizing coded algorithms:

function of duration, modified annualized, semi-annual C:

$$\text{(Duration) Durmodan} = \frac{\dfrac{C}{Y^2}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2T(100-C/Y)}{(1+Y)^{2T+1}}}{2P}$$

where $D = \Delta P/\Delta YTM$
        $Y = YTM$
        $T = $ Mat. in Years
        $C = $ Coupon
        P=Price (par=100),

wherein as coded computational processing algorithms:

semi-annual $\text{Durmodan=DURMOD}=((((C/2)/((Y/2)^2))*(1-(1/((1+(Y/2))^{(2*T)}))))$
                    $+((2*T)*(100-((C/2)/(Y/2))))/((1+(Y/2))^{((2*T)+1)})))/(2*P)$
                    where P = Price (of 100)

generalized $\text{Durmodan=DURMD}= ((((C/N)/((Y/N)^2))*(1-(1/((1+(Y/N))^{(N*T)}))))$
                    $+(((N*T)*(100-((C/N)/(Y/N))))/((1+(Y/N))^{((N*T)+1)})))/(2*P)$

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years;

function of convexity, semi-annual C:

$$\text{(Convexity) Convex} = \frac{\dfrac{2C}{Y^3}\left[1 - \dfrac{1}{(1+Y)^{2T}}\right] + \dfrac{2C(2T)}{Y^2(1+Y)^{2T+2}} + \dfrac{2T(2T+1)(100-C/Y)}{(1+Y)^{2T+2}}}{4P}$$

wherein as coded computational processing algorithms:

semi-annual $\text{Convex} = \text{CON} = (((C/((Y/2)^3))*(1-(1/((1+(Y/2))^{(2*T)}))))$
              $-((C*(2*T))/((Y/2)^2)*((1+(Y/2))^{((2*T)+1)}))$
              $+(((2*T)*((2*T)+1)*(100-(C/Y)))/((1+(Y/2))^{((2*T)+2)})))/(4*P)$

generalized $\text{Convex} = \text{CONDP} = (((C/((Y/N)^3))*(1-(1/((1+(Y/N))^{(N*T)}))))$
             $-((C*(N*T))/((Y/N)^2)*((1+(Y/N))^{((N*T)+1)}))$
             $+(((N*T)*((N*T)+1)*(100-(C/Y)))/((1+(Y/N))^{((N*T)+2)})))/(4*P)$

where N=n= # C periods per annum, e.g. semi-annual=2; T=Maturity in years;

function of theta, utilizing coded algorithm applicable if YTM or if Yield M:

generalized   Theta (θ), such a theta: $\theta = 2 \ln(1+r/2)$, wherein r = YTM or Yield M;

means sending said yield, and its derivatives, data set to data storage or digital output;

means computing factorization for change in price over time, comprising algorithm:

$$\Delta P = A + B + C + D$$

wherein,
  $\Delta P =$ change in bid price, for given changes in yield and time,
  $A = -abs(\text{Duration}) \times \text{Price(dirty)} \times \Delta Y$
  $B = \frac{1}{2} \times \text{Convexity} \times \text{Price(dirty)} \times (\Delta Y)^2$
  $C = \text{Theta} \times \text{Price(dirty)} \times \Delta t$
  $D = -(\Delta \text{ Accrued Interest, for given } \Delta t)$,
and wherein,
  Y (YTM), by Formula Yield M, or Yield Md, or
      YTM by non-summation or by summation form function,
  Duration by Formula K, or by first term Taylor series approximation,
  Convexity by Formula V, or by second term Taylor series approximation,
  Theta (θ), such a theta: $\theta = 2 \ln(1+r/2)$, wherein r = ytm,
  Price (dirty) equals bid price plus accumulated interest,
  Δt is elapsed time between two points whereby estimations are made,
  ΔP rounded to nearest pricing gradient, ΔP occurring Δt;

means sending said computed factorization values to data storage or digital output;

means tabling, charting and rendering said generated data of security or portfolio.

62.   An apparatus, processing data or transactions, an automated arbitrage engine, useful for automated computation and identification of profitable arbitrage differentials, comprising:

means inputting data from storage, from data-stream of an analytic valuation engine, or from real-time data-feed, said data comprising at least security's variables of price and yield;

means computing an arbitrage differential between market yield and governing yield, wherein calculating the magnitude and direction of said differential by uniform procedure;

means computing an arbitrage differential between precise price change and actual, wherein calculating the magnitude and direction of said differential by uniform procedure;

means sorting arbitrage opportunities by profit or loss, or spread or notch premiums.

63.   An integrated computer-based financial information and transaction processing system providing analytic processing, assessment of arbitrage spreads and execution of transactions, useful for automated computation of values and sensitivities, for automated computation of arbitrage differentials, and for real-time processing of transactions based thereon, comprising:

business logic computational engines of two core server-based systems: an analytic valuation engine, to facilitate the computation of governing yield and its derivatives data set and to facilitate the computation of change in price for given change in yield over a period of time; and an automated arbitrage engine, to facilitate the computation of arbitrage differentials between governing yield and market yield and arbitrage differentials between precise price change and actual notched price change for a given change in yield over a period of time;

real-time financial data-feed, wherein each said core business logic server receiving market pricing data from said data-feed, said data fed to cores for computational processing;

porting connections between core business logic engines and from each said engine to output, rendering and storage devices, such devices comprise printers, terminals and memory;

automated control sequences providing execution of computer-driven transactions;

telecommunications connections between system comprised of engines and external entities, such entities comprise the group of exchanges, broker/dealers, and investment entities;

protective devices, such comprise the group of encryption, gate-keepers and firewalls.

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US 089003601KP1

Creation date: 07-06-2004
Indexing Officer: THSU1 - TONY HSU
Team: 3600PrintWorkingFolder
Dossier: 08900360

Legal Date: 06-17-2004

No.	Doccode	Number of pages
1	AP.B	26

Total number of pages: 26

Remarks:

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